Wisconsin Highway Research Program
Request for Proposal for

Laboratory Study of High Performance Curing Compounds for Concrete Pavement

Proposals must be submitted
no later than
Wednesday, March 3, 2010

For further information regarding this RFP
contact Andrew Hanz
at (608) 262-3835
E-mail: ajhanz@wisc.edu

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Researcher Proposal Preparation Guidelines

WHRP Proposal Guidelines are available on the WHRP website (http://www.whrp.org/rfps-and-guidelines.html?current=three&sub=none). Please refer to these instructions in preparation of your response.

I. Background and Problem Statement

The Wisconsin Department of Transportation (WisDOT) has observed increased frequency of concrete scaling on urban projects during the first year of service. This is particularly evident in areas where chloride-laden snow storage occurs over the first winter season. Affected items include concrete pavement in the parking lane, curb and gutter, driveway aprons, sidewalks and paved terraces.

II. Objectives

It is WisDOT's goal to provide attractive, aesthetically pleasing surfaces on concrete items in urban settings where significant pedestrian traffic is present. The objective for this study is to evaluate several classifications of high performance curing compounds and cure and seal products to determine which are the most effective at prevention of scaling and chloride penetration.

III. Scope of Work

Proposal: In the initial project proposal, the research team will be expected to define their draft experimental design and explain the rationale for this design. The research team should also state as part of this experimental design, the total number of different PCC mixtures that will be tested within the defined budget for this study.

Task 1: Researcher shall develop a detailed final testing matrix in Task 1 for the prescribed testing for the spectrum of curing products against the required cross section of aggregates and cementitious materials. Final selection of aggregate sources shall be performed in consultation with WisDOT staff. The research team will be responsible for all aspects of materials procurement and transportation from the sources to their laboratory.

Task 2: will include the mixing of concrete, fabrication of test samples and measurement and documentation of concrete properties in the required testing matrix.

Task 3: will include analysis and summary of all test data, and preparation of final report

Required Concrete Properties to be Included in Test Matrix:
The following fresh concrete properties shall be measured per the cited specification procedures during lab batching:

- Slump (AASHTO T119)
- Air Content (AASHTO T152)
- Unit Weight (AASHTO T121)

The following hardened concrete properties shall be determined per the cited specification procedures:

- Resistance of Concrete to Chloride Ion Penetration (AASHTO T259)

- Standard Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals (ASTM C672)

Required Test Block Size and Other Modifications to Standard Test Procedures

- All test blocks for T259 and C672 shall have a minimum of 144 in^2 of exposed surface area between the dikes.
- Note that T259 and C672 each require three replicate blocks per test.
- C672 tests shall include a minimum of 50 freeze-thaw cycles. More cycles may be specified by the researcher if they feel it is essential to accomplishing the goals of the study.
- Forms for test blocks shall have a non-absorptive interior surface, and all seams shall be sealed to prevent moisture loss. (MDO or HDO plywood is satisfactory.)
- Mag float the test blocks the minimum amount necessary to close the surface, then apply a light broomed texture. (NO STEEL TROWELING)
- Test blocks shall be coated with selected curing compound at a coverage rate of 200 square feet per gallon as soon as excess bleed water has disappeared from the surface of the concrete.
- Test blocks shall be air cured in the forms in a room with 50% (+/-5%) relative humidity for 28 days at standard curing temperature, until just before dike construction prior to ponding.

Materials and Mix Proportion Requirements:

- All materials for concrete mixtures shall meet requirements of WisDOT Standard Specifications, except as modified below.
- All aggregate sources shall have a record of passing WisDOT aggregate quality tests.
- Coarse aggregate shall be 100 % WisDOT #1 stone (AASHTO #67) gradation.
- Fine aggregate shall be 40% of the total aggregate by weight.
- The Portland cement used shall be a Type I/II low alkali cement from a WisDOT certified source.
- The total cementitious materials content for all mixes shall be 470 lbs/cubic yard.
- Air content shall be 6% (+/-1.0%) for each batch.
- Slump shall be 3 inches (+/-1 inch).
- A standard dosage of low range water reducer shall be included in each batch.
- Vinsol resin type air agent shall be used in all batches.

Requirements for Test Matrix

Mix Variables

For each type of curing product to be tested, a full factorial of the following mix types must be include in the test matrix

- *30% Class C fly ash mix (approved WI source)
- *30% Grade 100 ground granulated blast furnace slag mix
- Northern WI aggregate mix
- Southern WI aggregate mix

*by weight of total cementitious materials

Northern coarse aggregate type shall be a typical northern WI glacial gravel. Southern coarse aggregate shall be a crushed limestone. Two sources of natural fine aggregate should be selected to compliment the coarse aggregate types. This would include a typical northern sand (principally igneous/metamorphic material) and a southern sand (with higher carbonate content).

Types of Curing Products Required in Test Matrix

- Control – Standard water-based wax-based curing compound per WisDOT specs
- Polyalphamethylstyrene curing compound meeting current WisDOT specs
- Linseed oil curing compound meeting current WisDOT specs
- Clear chlorinated rubber cure and seal from WisDOT approved list
- Clear acrylic cure and seal from WisDOT approved list

The researcher may also include additional types of curing compounds or cure and seal products that they feel may perform well in the tests based on their experience or information from literature review, as permitted within the constraints of the project budget.

WisDOT/Technical Oversight Committee (TOC) Contribution: TOC contact will consult with research team in final selection of aggregate sources.

Requirements for Laboratory/Technician Certifications: None

IV. Specific Results, Findings, Tools, etc. (Deliverables)

a) Reporting Requirements. 36 Hard Copies Delivered to WHRP by the contract end date.
b) Presentation Requirements. All projects require the PI to give a closeout presentation after submittal of the draft final report.

V. Budget and Time Frame

a) Proposed Project Duration is 12 months. (starting October 1, 2010 and ending September 30, 2011)
    - Deadline for submittal of draft final report is May 31, 2011.
    - Deadline for submittal of Final Report is September 30. 2011.
b) Project Budget shall not exceed $102,000.

VI. Implementation

a) This study will develop recommended values for concrete properties to be used by the Department in the MEPDG pavement design process.
b) Researcher is expected to communicate the following:
    i) Recommended potential changes in practice.
    ii) Benefits in terms of performance and cost savings.